ATTACHMENT Q

PALEONTOLOGICAL RESOURCES REPORT

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PALEONTOLOGICAL EVALUATION LANCASTER ENERGY FACILITY SITE AND GAS PIPELINE RIGHT-OF-WAY

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Executive Summary

Rock formations in the proposed energy facility site and the pipeline right-of-way have extremely limited potential to yield vertebrate fossils. Except for the Mesozoic igneous and the volcanic Oligocene-Miocene rocks in the Rosamond Hills portion of pipeline right-of-way, the entire study area encompasses a relatively featureless Holocene and Pleistocene landscape devoid of recorded vertebrate fossil localities or outcrops capable of yielding vertebrate fossils. The origin of igneous rocks precludes their potential to preserve or yield vertebrate fossils. Vertebrate fossils have been found in the foothills of the San Gabriel Mountains in the Harold Formation. Portions of the Harold Formation that are located within the proposed energy facility and pipeline right-of-way area; however, at least 400 feet below the surface and are not expected to be affected by construction or operational activities. Based on findings from a literature and database search, and a field survey: 1) the City of Lancaster Energy Facility site and the pipeline right-of-way are not considered paleontologically sensitive, and 2) vertebrate fossils are not expected to be found during construction.

Introduction

The proposed Lancaster Energy Facility and the gas pipeline right-of-way are located in the Antelope Valley area of southern California. Map coverage is on the West Lancaster, Rosamond, Soledad Mountain, and Mojave 7.5 Minute topographic maps (1:24000) published by the U.S. Geological Survey (Figure 1). Antelope Valley consists of two structural basins, the West and East Antelope Basins, separated from each other by a buried structural high (Dibblee 1967). The entire Antelope Valley is bounded to the south and southwest by the San Andreas Fault and Transverse Ranges and bounded to the north and northwest by the Garlock Fault and Tehachapi Mountains (Dibblee 1967; Woodburne 1975; Ponti1985). To the east, Antelope Valley is confluent with a series of small basins that eventually lead to the Colorado River Valley. Antelope Valley forms the westernmost wedge of the Mojave Desert and is within the larger Basin and Range physiographic provenience (Ponti 1985).

The proposed natural gas pipeline right-of-way extends from the proposed energy facility site at the intersection of Avenue H and Division Street in Lancaster to a

connection with an existing pipeline near the intersection of Highways 14 and 58 in Mojave. The right-of-way parallels the Sierra Highway and Union Pacific Railroad tracks to a point south of Mojave where it parallels Highway 14 to its connection with the existing pipeline.

Methods

Prior to a field survey, published literature and electronic databases was reviewed to determine if there were published or known vertebrate fossil localities in either the proposed Lancaster Energy Facility site or pipeline right-of-way. A pedestrian survey of the site was conducted on March 24, 2001. A vehicular survey that included pedestrian examination of potential outcrops within the proposed right-of-way was conducted April 21, 2001.

Geologic Summary

Geologic studies of Antelope valley have concentrated on the mountains that surround the valley (Dibblee, 1967; Woodburne, 1975). Filling of the Antelope Valley basins apparently began in the latest Oligocene (about 25 million years ago) and continues to the present (Woodburne, 1975; Ponti, 1985). Most of the basin fill, more than 6,000 feet thick, consists of loosely consolidated, Quaternary age (1.8 million years ago to 10,000 years ago) sediments (Ponti, 1985) and reflects a change in drainage patterns caused by the uplift of the San Gabriel Mountains between one and two million years ago (Woodburne, 1975).

The majority of the rocks exposed at the surface in Antelope Valley are late Quaternary (<500,000 years) and Holocene (<10,000 years old) in age (Ponti, 1985). The names given to the Quaternary and Holocene rocks vary according to who mapped them (Table 1).

Geologic maps of Antelope Valley that include the energy facility site and the pipeline right-of-way were published by Dibblee (1960, 1967) and Ponti et al. (1981). Dibblee (1960, 1967) did not map the Quaternary sediments in great detail (Figures 2 and 3). He simply divided the rocks into a younger alluvium (about 100 feet thick) and an older alluvium (more than 1,000 feet thick). Dibblee's younger alluvium is probably late

Quaternary and Holocene in age, and the older alluvium is most likely middle and early Quaternary in age. He noted that most of the basin fill in Antelope Valley was the older alluvium that included the Harold Formation and Nadeau Gravel of Nobel (1953). The proposed energy facility would be built on Dibblee's younger alluvium unit, specifically the facies he mapped as clay and silt. Except for the Rosamond Hills, all of the proposed pipeline right-of-way will traverse the younger alluvial unit of Dibblee (1960, 1967).

Ponti et al. (1981) mapped the different facies of Dibblee's (1960, 1967) younger alluvium in greater detail based on lithologic, pedologic, and geomorphic criteria. Ponti (1985) described and interpreted these map units and informally divided Dibblee's (1960, 1967) younger alluvium unit into eight sets of deposits. From oldest to youngest they are: the lower, middle, and upper Tylerhorse deposits; lower, middle and upper Palmdale deposits; and post-Palmdale I and II deposits (Table 1). Collectively, these units have a minimum thickness of 418 feet.

Upper Palmdale deposits (minimum thickness of 37 feet) cover most of the floor of Antelope Valley. The energy facility site is located on this unit, which is equivalent, in part, to Dibblee's (1960, 1967) younger alluvium. According to Ponti (1985, pg. 83) the upper Palmdale deposits "form low terraces in valleys along the foothills and grade into broad, smooth alluvial fans that blanket the basin floor. The surfaces of these deposits are generally flat-lying and undissected, but modern channels are incised at least 1 m."

In addition to alluvial fan deposits, the formations of Ponti et al. (1981) and Ponti (1985) also include lakebeds that formed in Lake Thompson, an extinct lake that filled part of Antelope Valley during the Quaternary (Dibblee, 1960, 1967). Rogers and Rosamond dry lakes occupy parts of the ancient bed of Lake Thompson.

These late Quaternary and Holocene rocks are composed of gravel, sand, silt and clay. Cementation tends to be poor. Paleosols are developed to varying degrees of maturity in these late Quaternary and Holocene units (Ponti, 1985). The composition and placement of the rocks are important in determining potential vertebrate fossil localities.

The older alluvium of Dibblee (1960, 1967) is not exposed at the surface in the area of the energy facility and is exposed only in a very limited area along the pipeline right-of-way (Figures 2 and 3). Dibblee's older alluvium has, however, been mapped in other areas of the Mojave Desert as the Harold Formation, Shoemaker Gravel, and

Nadeau Gravel (Nobel, 1953, 1954; Woodburne, 1975). These rocks are thought to be early and middle Quaternary in age (1.8 to 0.5 million years old) and are exposed only in the foothills of the Transverse Ranges and Tehachapi Mountains where fault movements and folding have brought them to the surface. Dibblee (1967), Woodburne (1975), and Ponti (1985) all assume that the late Quaternary rocks cover the older alluvium that underlies much or all of Antelope Valley. Nobel (1953, 1954) was of the opinion that the Harold Formation, Shoemaker Gravel, and Nadeau Gravel were deposited in small basins adjacent to the San Andreas Fault rather than forming widespread deposits.

No studies were identified that examined the deep subsurface older geology of either basin underlying Antelope Valley. Thus, the actual geologic formations underlying the late Quaternary and Holocene rocks are unknown. Lack of knowledge regarding the subsurface geology should not be an issue, however, unless the City of Lancaster energy facility and pipeline right-of-way foundations, footings or trenches are planned to be deeper than 400 feet.

Rosamond Hills

A segment of the pipeline right-of-way traverses a low saddle in the Rosamond Hills. Most of the rocks in the Rosamond Hills are intrusive and extrusive igneous (volcanic); however, there are also some re-deposited volcanic rocks and Quaternary-aged older alluvium (Dibblee 1967). Dibblee (1967) described the geologic formations in the Rosamond Hills from south to north within the right-of-way as:

1. An unnamed fanglomerate (sedimentary rock formed mainly of pebbles and cobbles with angular edges) that is part of the older alluvium unit of Quaternary age,
2. The Fiss Fanglomerate of possible Miocene age (23.5 to 5.5 million years ago); a brown colored rock derived from re-worked volcanics deposited by water and gravity,
3. The Gem Hill Formation of possible Oligocene to middle Miocene age (34 to 11.2 million years ago). It consists of reworked volcanics from the Bobtail Quartz Latite Member of the Gem Hill Formation and an unnamed unit of rhyolite tuff, tuff breccia, tuffaceous sandstone, and conglomerate. This

unnamed member of the Gem Hill Formation is mix of air-fall and re-worked volcanic ash; and

4. Quartz monzonite, a Mesozoic intrusive igneous rock (magma emplaced below the surface where it cooled into rock and later exposed by uplift and erosion).

No fossils are expected in the intrusive or extrusive igneous rocks; this type of rock forms from magma (very hot molten rock) that destroys any organic material. Dibblee (1967) also reported finding no fossils in the Rosamond Hills sedimentary rocks.

Vertebrate Paleontology of the Lancaster Energy Facility Site

A search of published literature and electronic databases for vertebrate fossil localities with regard to the Lancaster area, Antelope Valley, and the geologic rock units in these areas showed that there are:

1. No known vertebrate fossil localities at the energy facility site or the pipeline right-of-way.
2. The rocks included in the alluvial units of Dibblee (1960, 1967) or the Tylerhorse, Palmdale, post-Palmdale deposits of Ponti (1985) are not fossiliferous.
3. There have been no surveys for vertebrate fossils in the area of the proposed energy facility site, within the city limits of the City of Lancaster or within the proposed pipeline right-of-way.

The nearest vertebrate fossil locality is within the Harold Formation in the foothills on the north side of the San Gabriel Mountains (Nobel, 1953, 1954). No information was given about these fossils other than to list their taxa. Because Nobel worked for the U.S. Geological Survey, the fossils are presumably stored at a U.S. Geological Survey facility or the Smithsonian Institution. While portions of the Harold Formation are located within the proposed energy facility and pipeline right-of-way area, they are at least 400 feet below the surface and are not expected to be affected by construction or operational activities.

The potential for vertebrate fossils in the rocks immediately under the energy facility site or the pipeline right-of-way site is predicted to be extremely low. Based on findings from literature and database searches, it is predicted that the Lancaster Energy Facility site and the pipeline right-of-way are not paleontologically sensitive, and no vertebrate fossils are expected to be found during construction.

Field survey results

The Lancaster Energy Facility site is flat, and lacks outcrops of older formations that might yield vertebrate fossils. The only relief on the site consists of low mounds of coarse sand and silt held together by plant roots. (Figure 4). Areas between the vegetation mounds consist of very fine-grained sand, silt, and clay. Local residents have used the site as a garbage dump.

As predicted from the literature and database searches, no vertebrate fossils were found during the field survey. The only bones found were those of modern rabbit, cow and pig found in a garbage dump. The cow and pig bones show clear evidence of having come from a butcher shop. None of these bones qualifies as a fossil.

Geologically, the proposed pipeline right-of-way crosses three distinct areas (Figure 5). The first area extends from Lancaster to the Rosamond Hills (Figure 6). It is underlain by rocks of latest Pleistocene and Holocene age, i.e., the younger alluvium of Dibblee (1960, 1967) or the Upper Palmdale deposits of Ponti (1985). This area is very flat and there were no exposed outcrops (places to explore for fossils).

The second area consists of the low saddle through the Rosamond Hills (Figure 7). The rocks in the Rosamond Hills are mostly intrusive and extrusive (volcanic) igneous with some re-deposited volcanics plus very limited outcrops of the older alluvium unit (Dibblee, 1967). The third area extends from the Rosamond Hills to Mojave and consists of Dibblee's (1960, 1967) younger alluvium unit. Like the first area, the third is flat and no outcrops were found.

The only outcrop of rock that could be examined for possible fossils was of the Fiss Fanglomerate in the Rosamond Hills (Figure 8). No fossils were found either at this outcrop or at any other location within the right-of-way. Much of the terrain within the

right-of-way has already been disturbed by the construction of the railroad, Sierra Highway, Highway 14, a fiber optic cable, and another pipeline.

Conclusions

Based on findings from a literature and database search, and a field survey: 1) the City of Lancaster energy facility site and the pipeline right-of-way are not considered paleontologically sensitive, and 2) vertebrate fossils are not expected to be found during construction.

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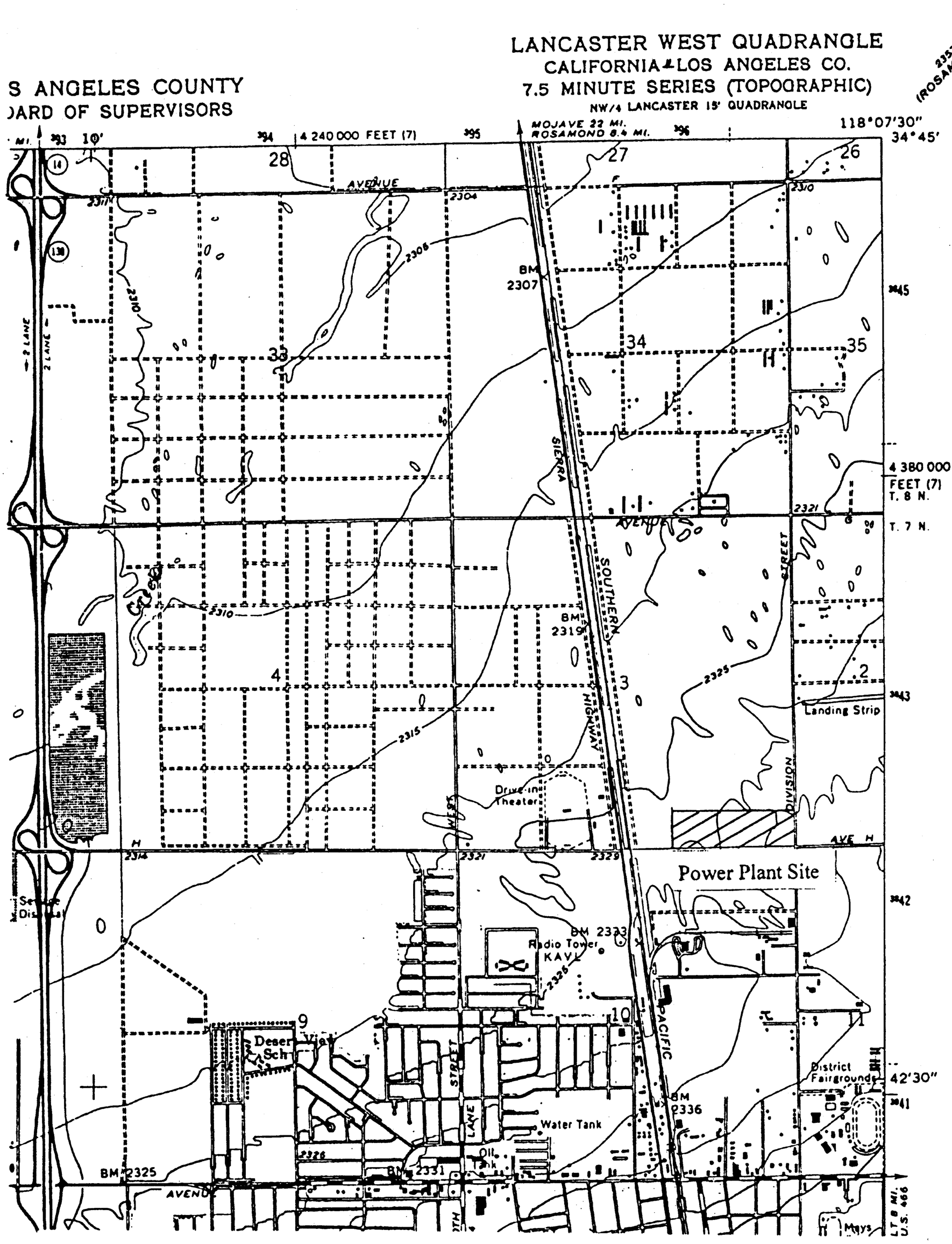
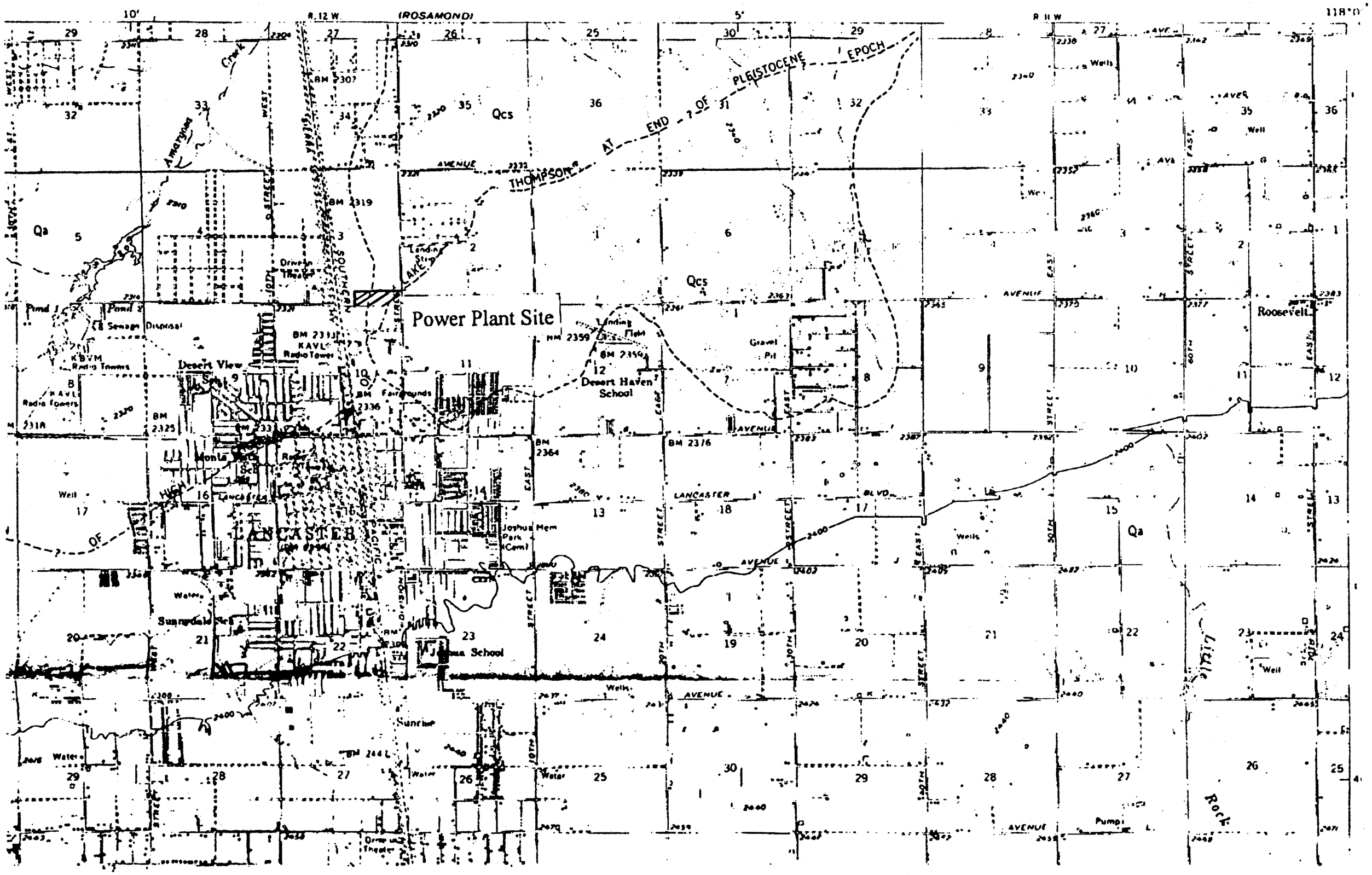


Figure 1. Location of the City of Lancaster power plant on the Lancaster West, 7.5 minute quadrangle (1:24,000).

Figure 2. Location of the City of Lancaster power plant on the 1:62,500 geologic map of Dibblee (1960). Qa = Quaternary alluvial gravel, sand, and silt. Qcs = Quaternary clay and silt. Both Qa and Qcs are part of Dibblee's "alluvium unit."



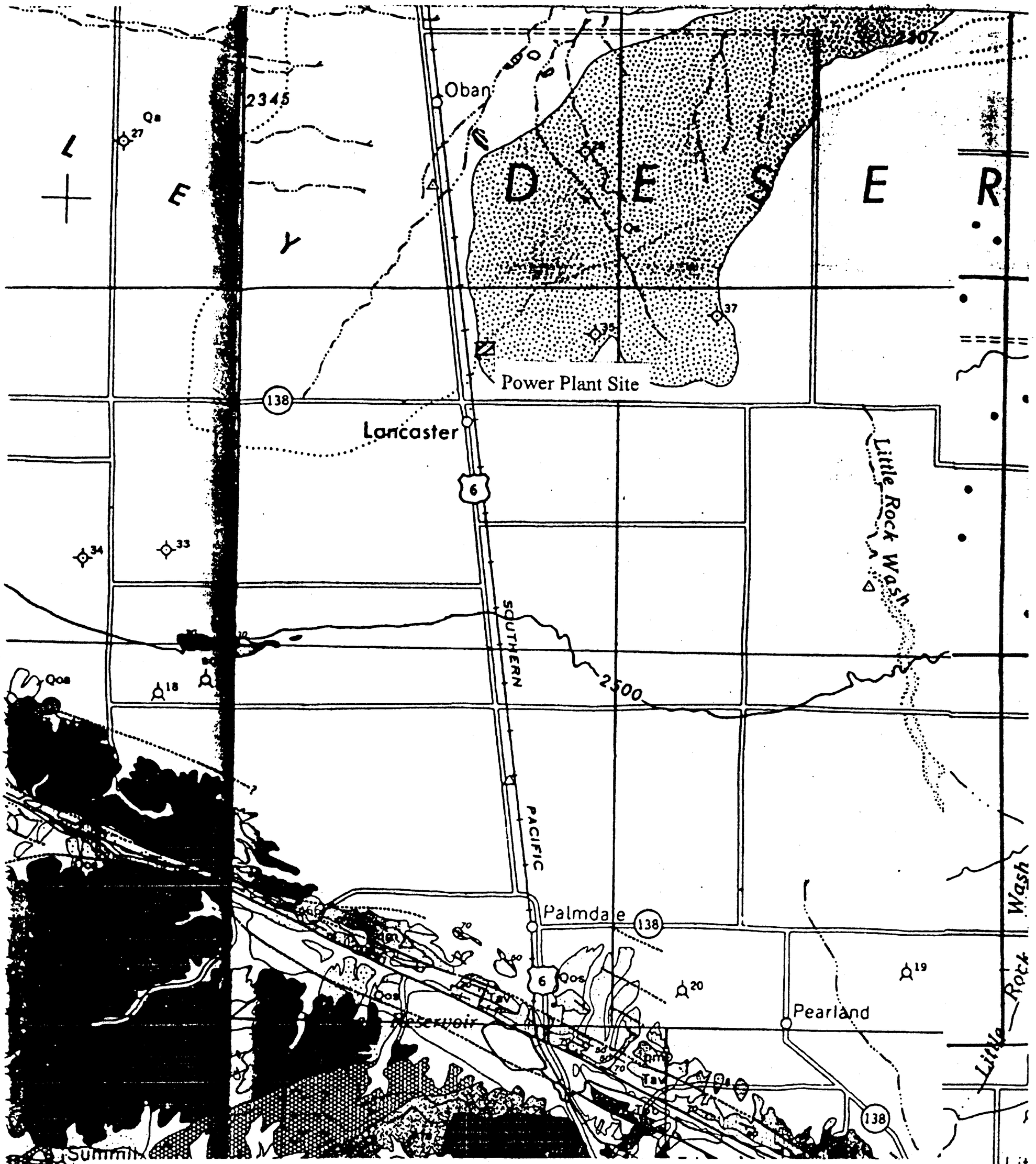


Figure 3. Location of the City of Lancaster power plant on the 1:125,000 geologic map of Dibblee (1967). Qa = Quaternary alluvium; undissected, unconsolidated gravel, sand, and silt. Qs = Quaternary wind-blown sand. Both Qa = Dibblee's (1960) "alluvium unit." This figure places the Lancaster area in a larger geologic context and shows than any potentially fossiliferous rocks are not close to the power plant site.

Table 1. Comparison of GeologicUnits
at the City of Lancaster Power Plant Site

			Dibblee(1960, 1967)	Ponti (1985)
Quaternary	Holocene		Alluvium	Post-Palmdale II Post-Palmdale I Upper Palmdale
	Pleistocene	Late		Middle Palmdale Upper Tylerhorse Middle Tylerhorse Lower Tylerhorse
		Early	Older alluvium (Not exposed, about 400' below surface)	Not mentioned in paper
Tertiary and older			Unknown, not exposed at the surface	Unknown, not exposed at the surface

Figure 4. Digital photograph of the site of the proposed City of Lancaster power plant looking north. Photograph taken from the corner of Division Street and Avenue “H”. Note the extensive vegetation cover and the lack of outcrops. The light colored areas between clumps of vegetation are hard-packed clay and silt equivalent to the Qcs unit of Dibblee (1960).

Pipeline connection to existing pipeline
Mojave
Oak Creek Pass
AQUEDUCT
ANGELES
LOS
Willow Spring Pumping Station
Cactus Mine
Double Eagle
Bobtail M
Tip Top Mine
Gloster
2932
2500
3060
3203
2958
2758
Willow Springs
Rosamond
Rosamond Dry Lake
2271
R 14 W
R 13 W
R 11 W
Pipeline right-of-way
PACIFIC
M O J A V
D E S E R
V A L L E Y
2345
2307
Oban
Power plant
Lancaster
Del Sur
138
6
466
ATCHISON TOPEKA & SANTA FE
Bissell
Little Rock Wash
SCALE 1:125000
2 0 2 4 6 8 10 MILES
2 0 2 4 6 8 10 KILOMETERS
CONTOUR INTERVALS 200 AND 500 FEET
DATUM IS MEAN SEA LEVEL

Figure 5

the map was published additional roads have been built, the road numbers have changed and the Union Pacific now owns the railway.

Abbreviations of the geologic units:

Qof = Older alluvium, fanglomerate facies, Pleistocene
Tf = Fiss Fanglomerate, ? Miocene
Tgh = Gem Hill Formations, unnamed tuffaceous member, ?Oligocene to middle Miocene
Tgb = Gem Hill Formation, Bobtail Quartz Latite Member, ?Oligocene to middle Miocene
qm = quartz monzonite, Mesozoic

Figure 6: Quaternary alluvium typical of areas 1 and 2 in the foreground with the Rosamond Hills in the background.

Figure 7: The Rosamond Hills.

Figure 8: Outcrop of the Fiss Fanglomerate in the Rosamond Hills.